

# Cap Implied Volatility





## Cap Volatility

### Cap Volatility Surface Introduction

- Cap volatility is quoted by implied volatilities rather than prices.
- An interest rate cap volatility surface is a three-dimensional plot of the implied volatility of a cap as a function of strike and maturity.
- The term structures of implied volatilities provide indications of the market's near- and long-term uncertainty about future short- and long-term forward rates.
- A crucial property of the implied volatility surface is the absence of arbitrage.



## Cap Volatility

# Volatility Surface Construction

- To construct a reliable volatility surface, it is necessarily to apply robust interpolation methods to a set of discrete volatility data.
  - Local Volatility Model:
  - Stochastic Volatility Models:
  - Parametric or Semi-Parametric Models: such as SVI, Omega
  - Market Volatility Model: directly modeling the implied volatility dynamics
  - Interpolation/Extrapolation Model: interpolating or extrapolating volatility data using specific function forms



## Cap Volatility

### Arbitrage Free Conditions

- Any volatility models must meet arbitrage free conditions.
- Typical arbitrage free conditions
  - Static arbitrage free condition:
  - Calendar arbitrage free condition:
  - Vertical (spread) arbitrage free condition:
  - Horizontal (butterfly) arbitrage free condition:





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### Arbitrage Free Conditions (Cont.)

- Vertical arbitrage free and horizontal arbitrage free conditions for cap volatility surfaces are based on different strikes
- There is no calendar arbitrage in cap volatility surfaces as caps with different maturities have different cash flows and are associated with different indices. In other words, they can be treated independently.
- At FinPricing, we use the SABR model to construct cap volatility surfaces following the best market practice.



# Thank You

Reference:

<https://finpricing.com/lib/EqWarrant.html>